CANCER-LINKED GENES AS TARGETS FOR CHEMOTHERAPY

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This application claims priority of U.S. Provisional Application Serial
No. 60/534,419, filed 6 January 2004, the disclosure of which is herein
10   incorporated by reference in its entirety.

15   **FIELD OF THE INVENTION**

The present invention relates to methods of screening cancer-linked
genes and expression products for involvement in the cancer initiation and
20   facilitation process as a means of cancer diagnosis as well as the use of such
genes for screening potential anti-cancer agents, including small organic
compounds and other molecules, and development of therapeutic agents, as
well as polynucleotide sequences representing new prostate-specific
transcripts coding for proteins that are potentially useful for the diagnosis,
25   screening and/or treatment of prostate cancer.

BACKGROUND OF THE INVENTION

30   Cancer-linked genes are valuable in that they indicate genetic
differences between cancer cells and normal cells, such as where a gene is
expressed in a cancer cell but not in a non-cancer cell, or where said gene is
over-expressed or expressed at a higher level in a cancer as opposed to
normal or non-cancer cell. In addition, the expression of such a gene in a
35   normal cell but not in a cancer cell, especially of the same type of tissue, can
indicate important functions in the cancerous process. For example, screening

assays for novel drugs are based on the response of model cell based systems *in vitro* to treatment with specific compounds. Such genes are also useful in the diagnosis of cancer and the identification of a cell as cancerous. Gene activity is readily measured by measuring the rate of production of gene

5   products, such as RNAs and polypeptides encoded by such genes. Where genes encode cell surface proteins, appearance of, or alterations in, such proteins, as cell surface markers, are an indication of neoplastic activity. Some such screens rely on specific genes, such as oncogenes (or gene mutations). In accordance with the present invention, a cancer-linked gene

10   has been identified and its putative amino acid sequence worked out. Such gene is useful in the diagnosing of cancer, the screening of anticancer agents and the treatment of cancer using such agents, especially in that these genes encode polypeptides that can act as markers, such as cell surface markers, thereby providing ready targets for anti-tumor agents such as antibodies,

15   preferably antibodies complexed to cytotoxic agents, including apoptotic agents.

BRIEF SUMMARY OF THE INVENTION

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In accordance with the present invention, there is provided herein a cancer specific gene, linked especially to prostate cancer, or otherwise involved in the cancer initiating and facilitating process and the derived amino acid sequence thereof, including a number of different transcripts derived from

25   said gene.

In one aspect, the present invention relates to a process for identifying an agent that modulates the activity of a cancer-related gene comprising:

(a) contacting a compound with a cell containing a gene that

30   corresponds to a polynucleotide having a sequence selected from the group consisting of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60,

62, 64, 65, 67 and 68 and under conditions promoting the expression of said gene, such as conditions of temperature and pH, the presence of nucleoside triphosphates, and enzymes that replicate or transcribe the sequence; and

(b) detecting a difference in expression of said gene relative to when said compound is not present

thereby identifying an agent that modulates the activity of a cancer-related gene.

In various embodiments of such a process, the cell is a cancer cell and the difference in expression is a decrease in expression. Such polynucleotides may also include those that have sequences identical to SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 or 69.

In another aspect, the present invention relates to a process for identifying an anti-neoplastic agent comprising contacting a cell exhibiting neoplastic activity with a compound first identified as a cancer related gene modulator using an assay process disclosed herein and detecting a decrease in said neoplastic activity after said contacting compared to when said contacting does not occur. Such neoplastic activity may include accelerated cellular replication and/or metastasis, and the decrease in neoplastic activity preferably results from the death of the cell, or senescence, terminal differentiation or growth inhibition.

The present invention also relates to a process for identifying an anti-neoplastic agent comprising administering to an animal exhibiting a cancer condition an effective amount of an agent first identified according to a process of one of one of the assays disclosed according to the invention and detecting a decrease in said cancerous condition.

The present invention further relates to a process for determining the cancerous status of a cell, comprising determining an increase in the level of

expression in said cell of at least one gene that corresponds to a polynucleotide having a sequence selected from the group consisting of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68

5   wherein an elevated expression relative to a known non-cancerous cell indicates a cancerous state or potentially cancerous state. Such elevated expression may be due to an increased copy number.

The present invention additionally relates to an isolated polypeptide,

10   encoded by one of the polynucleotide transcripts disclosed herein, comprising an amino acid sequence homologous to an amino acid sequence selected from the group consisting of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69 wherein any difference between said amino acid sequence and the corresponding

15   sequence of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69 is due solely to conservative amino acid substitutions and wherein said isolated polypeptide comprises at least one immunogenic fragment. In a preferred embodiment, the present invention encompasses an isolated polypeptide comprising an

20   amino acid sequence homologous to an amino acid sequence selected from the group consisting of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69.

The present invention also relates to an antibody that reacts with a

25   polypeptide as disclosed herein, preferably a polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. Such an antibody may be polyclonal, monoclonal, recombinant or synthetic in origin.

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In one such embodiment, said antibody is associated, either covalently or non-covalently, with a cytotoxic agent, for example, an

apoptotic agent. Thus, the present invention relates to an immunoconjugate comprising an antibody of the invention and a cytotoxic agent.

The present invention also relates to a process for treating cancer, or
5   protecting against cancer, comprising contacting a cancerous cell with an agent having activity against an expression product encoded by a gene sequence selected from the group consisting of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68. In one such
10 embodiment, the cancerous cell is contacted *in vivo*. In another such embodiment, said agent has affinity for said expression product. In a preferred embodiment, such agent is an antibody disclosed herein, such as an antibody that is specific or selective for, or otherwise reacts with, a polypeptide of the invention. In a preferred embodiment, the expression product is a polypeptide
15 incorporating an amino acid sequence selected from SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69.

The present invention further encompasses an immunogenic
20 composition comprising a polypeptide disclosed herein, as well as compositions formed using antibodies specific for these polypeptides.

The present invention is also directed to uses of such compositions. Such uses include a method for treating cancer in an animal afflicted
25 therewith comprising administering to said animal an amount of an immunogenic composition of one or more of the polypeptides disclosed herein where such amount is an amount sufficient to elicit the production of cytotoxic T lymphocytes specific for a polypeptide of the invention, preferably a polypeptide incorporating a sequence of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18,
30 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. In a preferred embodiment, the animal to be so treated is a human patient.

DEFINITIONS

As used herein, the terms "portion," "segment," and "fragment," when used in relation to polypeptides, refer to a continuous sequence of residues,
5   such as amino acid residues, which sequence forms a subset of a larger sequence. For example, if a polypeptide were subjected to treatment with any of the common endopeptidases, such as trypsin or chymotrypsin, the oligopeptides resulting from such treatment would represent portions, segments or fragments of the starting polypeptide. When used in relation to a polynucleotides, such
10 terms refer to the products produced by treatment of said polynucleotides with any of the common endonucleases.

As used herein, the term "isolated" means that the material is removed from its original environment (e.g., the natural environment if it is naturally
15 occurring). It could also be produced recombinantly and subsequently purified. For example, a naturally-occurring polynucleotide or polypeptide present in a living animal is not isolated, but the same polynucleotide or polypeptide, separated from some or all of the coexisting materials in the natural system, is isolated. Such polynucleotides, for example, those prepared recombinantly,
20 could be part of a vector and/or such polynucleotides or polypeptides could be part of a composition, and still be isolated in that such vector or composition is not part of its natural environment. In one embodiment of the present invention, such isolated, or purified, polypeptide is useful in generating antibodies for practicing the invention, or where said antibody is attached to a cytotoxic or
25 cytolytic agent, such as an apoptotic agent.

The term "percent identity" or "percent identical," when referring to a sequence, means that a sequence is compared to a claimed or described sequence after alignment of the sequence to be compared (the "Compared
30 Sequence") with the described or claimed sequence (the "Reference Sequence"). The Percent Identity is then determined according to the following formula:

Percent Identity = 100 [1-(C/R)]

wherein C is the number of differences between the Reference Sequence and

5   the Compared Sequence over the length of alignment between the Reference
Sequence and the Compared Sequence wherein (i) each base or amino acid in
the Reference Sequence that does not have a corresponding aligned base or
amino acid in the Compared Sequence and (ii) each gap in the Reference
Sequence and (iii) each aligned base or amino acid in the Reference Sequence

10   that is different from an aligned base or amino acid in the Compared Sequence,
constitutes a difference; and R is the number of bases or amino acids in the
Reference Sequence over the length of the alignment with the Compared
Sequence with any gap created in the Reference Sequence also being counted
as a base or amino acid.

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If an alignment exists between the Compared Sequence and the
Reference Sequence for which the percent identity as calculated above is about
equal to or greater than a specified minimum Percent Identity then the
Compared Sequence has the specified minimum percent identity to the

20   Reference Sequence even though alignments may exist in which the
hereinabove calculated Percent Identity is less than the specified Percent
Identity.

As known in the art "similarity" between two polypeptides is determined

25   by comparing the amino acid sequence and its conserved amino acid
substitutes of one polypeptide to the sequence of a second polypeptide.

In accordance with the present invention, the term "DNA segment" or
"DNA sequence" refers to a DNA polymer, in the form of a separate fragment

30   or as a component of a larger DNA construct, which has been derived from
DNA isolated at least once in substantially pure form, i.e., free of
contaminating endogenous materials and in a quantity or concentration

enabling identification, manipulation, and recovery of the segment and its component nucleotide sequences by standard biochemical methods, for example, using a cloning vector. Such segments are provided in the form of an open reading frame uninterrupted by internal nontranslated sequences, or
5   introns, which are typically present in eukaryotic genes. Sequences of non-translated DNA may be present downstream from the open reading frame, where the same do not interfere with manipulation or expression of the coding regions.

10   The term "coding region" refers to that portion of a gene which either naturally or normally codes for the expression product of that gene in its natural genomic environment, i.e., the region coding *in vivo* for the native expression product of the gene. The coding region can be from a normal, mutated or altered gene, or can even be from a DNA sequence, or gene,
15   wholly synthesized in the laboratory using methods well known to those of skill in the art of DNA synthesis.

In accordance with the present invention, the term "nucleotide sequence" refers to a heteropolymer of deoxyribonucleotides. Generally, DNA
20   segments encoding the proteins provided by this invention are assembled from cDNA fragments and short oligonucleotide linkers, or from a series of oligonucleotides, to provide a synthetic gene which is capable of being expressed in a recombinant transcriptional unit comprising regulatory elements derived from a microbial, eukaryotic or viral operon.
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The term "expression product" means that polypeptide or protein that is the natural translation product of the gene and any nucleic acid sequence coding equivalents resulting from genetic code degeneracy and thus coding for the same amino acid(s).
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The term "active fragment," when referring to a coding sequence, means a portion comprising less than the complete coding region whose expression

product retains essentially the same biological function or activity as the expression product of the complete coding region.

5   The term "primer" means a short nucleic acid sequence that is paired with one strand of DNA and provides a free 3'-OH end at which a DNA polymerase starts synthesis of a deoxyribonucleotide chain.

The term "promoter" means a region of DNA involved in binding of RNA polymerase to initiate transcription. The term "enhancer" refers to a region of
10   DNA that, when present and active, has the effect of increasing expression of a different DNA sequence that is being expressed, thereby increasing the amount of expression product formed from said different DNA sequence.

The term "open reading frame (ORF)" means a series of triplets coding for amino acids without any termination codons and is a sequence
15   (potentially) translatable into protein.

As used herein, reference to a "DNA sequence" includes both single stranded and double stranded DNA. Thus, the specific sequence, unless the context indicates otherwise, refers to the single strand DNA of such
20   sequence, the duplex of such sequence with its complement (double stranded DNA) and the complement of such sequence.

As used herein, "corresponding genes" refers to genes that encode an RNA that is at least 90% identical, preferably at least 95% identical, most
25   preferably at least 98% identical, and especially identical, to an RNA encoded by one of the nucleotide sequences disclosed herein (i.e., SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68). Such genes
30   will also encode the same polypeptide sequence as any of the sequences disclosed herein, preferably SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52,

54, 56, 58, 60, 62, 64, 65, 67 and 68, but may include differences in such amino acid sequences where such differences are limited to conservative amino acid substitutions, such as where the same overall three dimensional structure, and thus the same antigenic character, is maintained. Thus, amino

5   acid sequences may be within the scope of the present invention where they react with the same antibodies that react with polypeptides comprising the sequences of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. A "corresponding gene" includes splice variants thereof.

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The genes identified by the present disclosure are considered "cancer-related" genes, as this term is used herein, and include genes expressed at higher levels (due, for example, to elevated rates of expression, elevated extent of expression or increased copy number) in cancer cells relative to

15   expression of these genes in normal (i.e., non-cancerous) cells where said cancerous state or status of test cells or tissues has been determined by methods known in the art, such as by reverse transcriptase polymerase chain reaction (RT-PCR) as described in the Examples herein. In specific embodiments, this relates to the genes whose sequences correspond to the

20   sequences of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68.

As used herein, the term "conservative amino acid substitution" is

25   defined herein as an exchange within one of the following five groups:

I. Amino acids with non-polar R groups:
            Gly, Ala, Val, Leu, Ile, Pro, Met

30   II. Amino acids with uncharged polar R groups:
            Ser, Thr, Cys

III. Amino acids with aromatic rings

Phe, Tyr, Trp

IV. Acidic amino acids and their amides

5   Asp, Asn, Glu, Gln

V. Basic Amino Acids:

Lys, Arg, His

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DETAILED SUMMARY OF THE INVENTION

The present invention relates to processes for utilizing a nucleotide
15 sequence for a cancer-linked gene, polypeptides encoded by such sequences
and antibodies reactive with such polypeptides in methods of treating and
diagnosing cancer, preferably prostate cancer, and in carrying out screening
assays for agents effective in reducing the activity of cancer-linked genes and
thereby treating a cancerous condition.
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The proteins useful in the invention are anion transport proteins and
are specific for prostate tissue as well as being specific for prostate cancer.
Thus, the presence of such antigens is diagnostic for prostate cancer.

25   The polypeptides disclosed herein incorporate various polynucleotide
transcripts (SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26,
28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62,
64, 65, 67 and 68) and the derived amino acid sequence (SEQ ID NO: 2, 5, 7,
9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59,
30 61, 63, 66 and 69) from said transcripts are available as targets for
chemotherapeutic agents, especially anti-cancer agents, including antibodies
specific for said polypeptides.

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The cancer-related polynucleotide sequences disclosed herein correspond to gene sequences whose expression is indicative of the cancerous status of a given cell. Such sequences are substantially identical to

5   SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, which represent different transcripts identified from the GenBank EST database and which exhibit cancer-specific expression. The polynucleotides of the invention are those that correspond to a sequence of SEQ ID NO: 1, 3,

10   4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68. Such sequences have been searched within the GenBank database, especially the EST database, with the following results:

15   In a GX2000 screen for genes specifically expressed in prostate tissue the following ESTs were identified. The Gencarta program or custom EST clustering or Unigene clusters elongated these sequences and predicted protein coding capacity of these elongated sequences. Some of these sequences represent 'known' sequences that are available as 'hypothetical' or

20·   'known' proteins in the database. Where indicated, these sequences represent transmembrane proteins. These are especially useful as diagnostic markers, for screening purposes and treatment.

The genes useful in the methods of the present invention (along with

25   GenBank accession numbers) include the following:

1. BC006219 (SMP1, Unigene cluster Hs.447531), coding for BC006219, similar to mesoderm posterior 1 (MESP1), also expressed in malignant endometrium. This corresponds to SEQ ID NO: 1, encoding the

30   polypeptide with amino acid sequence of SEQ ID NO: 2.

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2. AW245867 (updated as AW137133; Unigene cluster Hs.163113, updated as Hs.245867), is extended by the Gencarta program that predicts 4 different splice variants, all of them with protein coding capacity. SAGE data for the splice variants suggests expression preferentially in prostate. The

5   variants include SEQ ID NO: 3, 4, 6, 8 and 10, which encode polypeptides with SEQ ID NO: 5, 7, 9 and 11.

3. AB059429 (Unigene cluster Hs.306812, SEQ ID NO: 12) coding for protein BAB64535 'Butyryl-CoA-Synthetase 1' (SEQ ID NO:13). Expressed

10   selectively in prostate cancer, virtually no expression in nonmalignant tissue.

4. BC001186 (Unigene cluster Hs.119693, SEQ ID NO: 14) coding for protocadherin beta 5 (PCDHB5, SEQ ID NO: 15, see BAB64535) Transmembrane protein.

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5. AI741645 (Unigene cluster Hs.125350, SEQ ID NO: 16) sequence is extended by Gencarta program that predicts to alternatively spliced forms (SEQ ID NO: 17 and 19), one of them (SEQ ID NO: 17) with protein (SEQ ID NO: 18) coding capacity.

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6. AL043002 (Unigene cluster Hs.469918, SEQ ID NO: 20), sequence is identical to AL136789 (Unigene cluster Hs.469927, SEQ ID NO: 21), nucleotide sequence for 'hypothetical protein dkfz p434F1719' with amino acid sequence CAB66723 (SEQ ID NO: 22).

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7. BC004992 (Unigene cluster Hs. 148322, SEQ ID NO: 23) coding for AAH04992 'hypothetical protein MGC4400' (SEQ ID NO:24) and CAB66723. The protein contains a 'KRAB' motive for transcriptional repression and 8 Zinc finger domains for DNA binding. Expression is largely prostate cancer

30   specific, i.e. no expression in normal prostate tissue and BPH.

8. AI953589 (Unigene cluster Hs.373533, updated Hs.145251, SEQ ID NO: 25) coding for the protein 'Mirror-image polydactyly 1(MIPOL1)'. Gencarta predicts 10 splice variants with protein coding capacity, variant 3 representing the actual published MIPOL1. Only variants 1, 4, 5, 6, and 7 contain the EST sequence AI953589 (updated as AAH04992, zinc finger protein 577 (ZNF577) and represent prostate specific transcripts. Variants 4 (SEQ ID NO: 28, encoding the polypeptide of SEQ ID NO: 29), variant 5 (SEQ ID NO: 30, encoding the polypeptide of SEQ ID NO: 31), variant 6 (SEQ ID NO: 32, encoding the polypeptide of SEQ ID NO: 33), and variant 7 (SEQ ID NO: 34, encoding the polypeptide of SEQ ID NO: 35) lead to the same protein as variant 3 (MIPOL1) and can be selectively targeted by RNAi because of their unique 3'-ends. Variant 1 (SEQ ID NO: 26, encoding the polypeptide of SEQ ID NO: 27) displays a unique N-terminus on the polypeptide (with the unique peptide HAATTLLILHRYRLNEGFLLGLDP), representing a prostate specific antigen. The variants also encode polypeptides of SEQ ID NO: 29, 29, 31, 33 and 35.

9. NM_024788, (Unigene cluster Hs.521012) with splice variant 1 (SEQ ID NO: 36, encoding the polypeptide of SEQ ID NO: 37, hypothetical protein FLJ), variant 2 (SEQ ID NO: 38, encoding the polypeptide of SEQ ID NO: 39), variant 3 (SEQ ID NO: 40, encoding the polypeptide of SEQ ID NO: 41), and variant 4 (SEQ ID NO: 42, encoding the polypeptide of SEQ ID NO: 43).

10. BF447038 (Unigene cluster Hs.195992, Q ID NO: 44) and AK056857 (SEQ ID NO: 45) and polypeptide (SEQ ID NO: 46, BAB71297).

11. AW167298 (Unigene cluster Hs.534881, SEQ ID NO: 47) including splice variant 1 (SEQ ID NO: 48, encoding the polypeptide of SEQ ID NO: 49), variant 2 (SEQ ID NO: 50), variant 3 (SEQ ID NO: 51) and variant 4 (SEQ ID NO: 52, encoding the polypeptide of SEQ ID NO: 53).

12. BG032839 (Unigene cluster Hs.530660, SEQ ID NO: 54, encoding the polypeptide of SEQ ID NO: 55).

13. AL450314, AL589866 and AL590118, (Unigene cluster Hs.360940)
5   with splice variants encoding a serine hydrolase-like protein, including variant 1 (SEQ ID NO: 56, encoding the polypeptide of SEQ ID NO: 57), variant 2 (SEQ ID NO: 58, encoding the polypeptide of SEQ ID NO: 59), variant 3 (SEQ ID NO: 60, encoding the polypeptide of SEQ ID NO: 61) and variant 4 (SEQ ID NO: 62, encoding the polypeptide of SEQ ID NO: 63).
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14. NM_023938 (Unigene cluster Hs.223394, updated Hs.32417, SEQ ID NO: 64) coding for a 'hypothetical protein MGC2742' (SEQ ID NO: 66). The corresponding cDNA is SEQ ID NO: 65.

15   15. AL590118 (Unigene cluster Hs.348556, updated Hs.360940, SEQ ID NO: 67) coding for a hypothetical protein CGI-96 (SEQ ID NO: 69, for which the corresponding cDNA is SEQ ID NO: 68).

20   The nucleotides and polypeptides, as gene products, used in the processes of the present invention may comprise a recombinant polynucleotide or polypeptide, a natural polynucleotide or polypeptide, or a synthetic polynucleotide or polypeptide, or a recombinant polynucleotide or polypeptide.

25   Fragments of such polynucleotides and polypeptides as are disclosed herein may also be useful in practicing the processes of the present invention. For example, a fragment, derivative or analog of the polypeptide (SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69) may be (i) one in which one or more of the amino
30   acid residues are substituted with a conserved or non-conserved amino acid residue (preferably a conserved amino acid residue) and such substituted amino acid residue may or may not be one encoded by the genetic code, or (ii) one in

which one or more of the amino acid residues includes a substituent group, or (iii) one in which the mature polypeptide is fused with another compound, such as a compound to increase the half-life of the polypeptide (for example, polyethylene glycol), or (iv) one in which the additional amino acids are fused to

5   the mature polypeptide, such as a leader or secretory sequence or a sequence which is employed for purification of the mature polypeptide (such as a histidine hexapeptide) or a proprotein sequence. Such fragments, derivatives and analogs are deemed to be within the scope of those skilled in the art from the teachings herein.

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In another aspect, the present invention relates to an isolated polypeptide, including a purified polypeptide, comprising an amino acid sequence at least 90% identical to the amino acid sequence of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55,

15   57, 59, 61, 63, 66 and 69. In preferred embodiments, said isolated polypeptide comprises an amino acid sequence having sequence identity of at least 95%, preferably at least about 98%, and especially is identical to, the sequence of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. The present invention also includes

20   isolated active fragments of such polypeptides where said fragments retain the biological activity of the polypeptide or where such active fragments are useful as specific targets for cancer treatment, prevention or diagnosis. Thus, the present invention relates to any polypeptides, or fragments thereof, with sufficient sequence homology to the sequences disclosed herein as to be useful

25   in the production of antibodies that react with (i.e., are selective or specific for) the polypeptides of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69 so as to be useful in targeting cells that exhibit such polypeptides, or fragments, on their surfaces, thereby providing targets for such antibodies and therapeutic agents

30   associated with such antibodies.

The polynucleotides and polypeptides useful in practicing the processes of the present invention may likewise be obtained in an isolated or purified form. In addition, the polypeptide disclosed herein as being useful in practicing the processes of the invention are believed to be surface proteins present on cells,

5   such as cancerous cells. Precisely how such cancer-linked proteins are used in the processes of the invention may thus differ depending on the therapeutic approach used. For example, cell-surface proteins, such as receptors, are desirable targets for toxic antibodies that can be generated against the polypeptides disclosed herein.

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The sequence information disclosed herein, as derived from the GenBank submissions, can readily be utilized by those skilled in the art to prepare the corresponding full-length polypeptide by peptide synthesis. The same is true for either the polynucleotides or polypeptides disclosed herein for

15   use in the methods of the invention.

The present invention relates to an isolated polypeptide, encoded by one of the polynucleotide transcripts disclosed herein, comprising an amino acid sequence homologous to an amino acid sequence selected from the

20   group consisting of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69, wherein any difference between amino acid sequence in the isolated polypeptide and the sequence of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69 is due solely to

25   conservative amino acid substitutions and wherein said isolated polypeptide comprises at least one immunogenic fragment. In a preferred embodiment, the present invention encompasses an isolated polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57,

30   59, 61, 63, 66 and 69.

Computer algorithms, for example SYFPEITHI (Rammensee H, et al., SYFPEITHI: database for MHC ligands and peptide motifs. Immunogenetics 50:213-219 (1999) can be used for the prediction of immunogenic HLA binding peptides like those disclosed herein and that can be subsequently

5   identified by experimental methods well known in the art (Schmitz M, et al., EP.Generation of survivin-specific CD8+ T effector cells by dendritic cells pulsed with protein or selected peptides. Cancer Research, 60(17):4845-9 (2000); Kiessling A, et al., EP.Prostate stem cell antigen: Identification of immunogenic peptides and assessment of reactive CD8+ T cells in prostate

10   cancer patients, Int'l J. Cancer, 102(4):390-7 (2002).

Methods of producing recombinant cells and vectors useful in preparing the polynucleotides and polypeptides disclosed herein are well known to those skilled in the molecular biology art. See, for example,

15   Sambrook, et al., Molecular Cloning: A Laboratory Manual, Second Edition, Cold Spring Harbor, N.Y., (1989), Wu et al., *Methods in Gene Biotechnology* (CRC Press, New York, NY, 1997), and *Recombinant Gene Expression Protocols*, in *Methods in Molecular Biology*, Vol. 62, (Tuan, ed., Humana Press, Totowa, NJ, 1997), the disclosures of which are hereby incorporated by reference.

20
In one aspect, the present invention relates to a process for identifying an agent that modulates the activity of a cancer-related gene comprising:

(a) contacting a compound with a cell containing a gene that corresponds to a polynucleotide having a sequence selected from the group

25   consisting of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68 and under conditions promoting the expression of said gene; and

(b) detecting a difference in expression of said gene relative to when

30   said compound is not present

thereby identifying an agent that modulates the activity of a cancer-related gene.

In specific embodiments of such process the cell is a cancer cell and the difference in expression is a decrease in expression. Such polynucleotides may also include those that have sequences identical to SEQ

5   ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68.

In another aspect, the present invention relates to a process for

10   identifying an anti-neoplastic agent comprising contacting a cell exhibiting neoplastic activity with a compound first identified as a cancer related gene modulator using an assay process disclosed herein and detecting a decrease in said neoplastic activity after said contacting compared to when said contacting does not occur. Such neoplastic activity may include accelerated

15   cellular replication and/or metastasis, and the decrease in neoplastic activity preferably results from the death of the cell.

The present invention also relates to a process for identifying an anti-neoplastic agent comprising administering to an animal exhibiting a cancer

20   condition an effective amount of an agent first identified according to a process of one of one of the assays disclosed according to the invention and detecting a decrease in said cancerous condition.

In specific embodiments of the present invention, the genes useful for

25   the invention comprise genes that correspond to polynucleotides having a sequence selected from SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, or may comprise the sequence of any of the polynucleotides disclosed herein (where the latter are cDNA sequences).

30

In accordance with the present invention, such assays rely on methods of determining the activity of the gene in question. Such assays are

advantageously based on model cellular systems using cancer cell lines, primary cancer cells, or cancerous tissue samples that are maintained in growth medium and treated with compounds at a single concentration or at a range of concentrations. At specific times after treatment, cellular RNAs are
5   conveniently isolated from the treated cells or tissues, which RNAs are indicative of expression of selected genes. The cellular RNA is then divided and subjected to differential analysis that detects the presence and/or quantity of specific RNA transcripts, which transcripts may then be amplified for detection purposes using standard methodologies, such as, for example,
10   reverse transcriptase polymerase chain reaction (RT-PCR), etc. The presence or absence, or concentration levels, of specific RNA transcripts are determined from these measurements. The polynucleotide sequences disclosed herein are readily used as probes for the detection of such RNA transcripts and thus the measurement of gene activity and expression.

15

The polynucleotides of the invention can include fully operational genes with attendant control or regulatory sequences or merely a polynucleotide sequence encoding the corresponding polypeptide or an active fragment or analog thereof.

20

Expression of the polynucleotide sequences disclosed herein are specific to prostate and may be specific for the cancerous state, useful gene modulation is downward modulation, so that, as a result of exposure to an antineoplastic agent identified by the screening assays herein, the
25   corresponding gene of the cancerous cell is expressed at a lower level (or not expressed at all) when exposed to the agent as compared to the expression when not exposed to the agent. For example, the gene sequences disclosed herein (SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64,
30   65, 67 and 68) correspond to a gene expressed at a higher level in cells of prostate cancer than in normal prostate cells. Thus, where said chemical agent causes this gene of the tested cell to be expressed at a lower level than

the same genes of the reference, this is indicative of downward modulation and indicates that the chemical agent to be tested has anti-neoplastic activity.

In carrying out the assays disclosed herein, relative antineoplastic activity may be ascertained by the extent to which a given chemical agent modulates the expression of genes present in a cancerous cell. Thus, a first chemical agent that modulates the expression of a gene associated with the cancerous state (i.e., a gene corresponding to one or more of the polynucleotide transcripts disclosed herein) to a larger degree than a second chemical agent tested by the assays of the invention is thereby deemed to have higher, or more desirable, or more advantageous, anti-neoplastic activity than said second chemical agent.

The gene expression to be measured is commonly assayed using RNA expression as an indicator. Thus, the greater the level of RNA (for example, messenger RNA or mRNA) detected the higher the level of expression of the corresponding gene. Thus, gene expression, either absolute or relative, is determined by the relative expression of the RNAs encoded by such genes.

RNA may be isolated from samples in a variety of ways, including lysis and denaturation with a phenolic solution containing a chaotropic agent (e.g., trizol) followed by isopropanol precipitation, ethanol wash, and resuspension in aqueous solution; or lysis and denaturation followed by isolation on solid support, such as a Qiagen resin and reconstitution in aqueous solution; or lysis and denaturation in non-phenolic, aqueous solutions followed by enzymatic conversion of RNA to DNA template copies.

Normally, prior to applying the processes of the invention, steady state RNA expression levels for the genes, and sets of genes, disclosed herein will have been obtained. It is the steady state level of such expression that is affected by potential anti-neoplastic agents as determined herein. Such steady state levels of expression are easily determined by any methods that are sensitive, specific and accurate. Such methods include, but are in no way limited

to, real time quantitative polymerase chain reaction (PCR), for example, using a Perkin-Elmer 7700 sequence detection system with gene specific primer probe combinations as designed using any of several commercially available software packages, such as Primer Express software., solid support based hybridization

5   array technology using appropriate internal controls for quantitation, including filter, bead, or microchip based arrays, solid support based hybridization arrays using, for example, chemiluminescent, fluorescent, or electrochemical reaction based detection systems.

10   The gene expression indicative of a cancerous state need not be characteristic of every cell of a given tissue. Thus, the methods disclosed herein are useful for detecting the presence of a cancerous condition within a tissue where less than all cells exhibit the complete pattern. Thus, for example, a selected gene corresponding to the sequence of SEQ ID NO: 1,

15   may be found, using appropriate probes, either DNA or RNA, to be present in as little as 60% of cells derived from a sample of tumorous, or malignant, tissue. In a highly preferred embodiment, such gene pattern is found to be present in at least 100% of cells drawn from a cancerous tissue and absent from at least 100% of a corresponding normal, non-cancerous, tissue sample.

20

Expression of a gene may be related to copy number, and changes in expression may be measured by determining copy number. Such change in gene copy number may be determined by determining a change in expression of messenger RNA encoded by a particular gene sequence, especially that of

25   SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68. Also in accordance with the present invention, said gene may be a cancer initiating or facilitating gene. In carrying out the methods of the present invention, a cancer facilitating gene is a gene that, while not directly initiating

30   tumor formation or growth, acts, such as through the actions of its expression product, to direct, enhance, or otherwise facilitate the progress of the cancerous condition, including where such gene acts against genes, or gene

expression products, that would otherwise have the effect of decreasing tumor formation and/or growth.

5   Although the expression of a gene corresponding to a sequence of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68 may be indicative of a cancerous status for a given cell, the mere presence of such a gene may not alone be sufficient to achieve a malignant condition and thus the level of expression of such gene may also be a
10   significant factor in determining the attainment of a cancerous state. Thus, it becomes essential to also determine the level of expression of a gene as disclosed herein, including substantially similar sequences, as a separate means of diagnosing the presence of a cancerous status for a given cell, groups of cells, or tissues, either in culture or *in situ*.
15

The level of expression of the polypeptides disclosed herein is also a measure of gene expression, such as polypeptides having sequence identical, or similar to, any polypeptide encoded by a sequence of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42,
20   44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, especially a polypeptide whose amino acid sequence is the sequence of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69.

25   In accordance with the foregoing, the present invention specifically contemplates a method for determining the cancerous status of a cell to be tested, comprising determining the level of expression in said cell of a gene that includes one of the nucleotide sequences selected from the sequences of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32,
30   34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, including sequences substantially identical to said sequences, or characteristic fragments thereof, or the complements of any of the foregoing

and then comparing said expression to that of a cell known to be non-cancerous whereby the difference in said expression indicates that said cell to be tested is cancerous.

5   In accordance with the invention, although gene expression for a gene that includes as a portion thereof one of the sequences of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, is preferably determined by use of a probe that is a fragment of such nucleotide sequence,
10   it is to be understood that the probe may be formed from a different portion of the gene. Expression of the gene may be determined by use of a nucleotide probe that hybridizes to messenger RNA (mRNA) transcribed from a portion of the gene other than the specific nucleotide sequence disclosed herein.

15   It should be noted that there are a variety of different contexts in which genes have been evaluated as being involved in the cancerous process. Thus, some genes may be oncogenes and encode proteins that are directly involved in the cancerous process and thereby promote the occurrence of cancer in an animal. In addition, other genes may serve to suppress the
20   cancerous state in a given cell or cell type and thereby work against a cancerous condition forming in an animal. Other genes may simply be involved either directly or indirectly in the cancerous process or condition and may serve in an ancillary capacity with respect to the cancerous state. All such types of genes are deemed with those to be determined in accordance
25   with the invention as disclosed herein. Thus, the gene determined by said process of the invention may be an oncogene, or the gene determined by said process may be a cancer facilitating gene, the latter including a gene that directly or indirectly affects the cancerous process, either in the promotion of a cancerous condition or in facilitating the progress of cancerous growth or
30   otherwise modulating the growth of cancer cells, either *in vivo* or *ex vivo*. In addition, the gene determined by said process may be a cancer suppressor gene, which gene works either directly or indirectly to suppress the initiation or

progress of a cancerous condition. Such genes may work indirectly where their expression alters the activity of some other gene or gene expression product that is itself directly involved in initiating or facilitating the progress of a cancerous condition. For example, a gene that encodes a polypeptide,

5   either wild or mutant in type, which polypeptide acts to suppress of tumor suppressor gene, or its expression product, will thereby act indirectly to promote tumor growth.

As noted previously, polynucleotides encoding the same proteins as

10   any of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, regardless of the percent identity of such sequences, are also specifically contemplated by any of the methods of the present invention that rely on any or all of said sequences, regardless of how they are otherwise

15   described or limited. Thus, any such sequences are available for use in carrying out any of the methods disclosed according to the invention. Such sequences also include any open reading frames, as defined herein, present within the sequence of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56,

20   58, 60, 62, 64, 65, 67 and 68.

Because a gene disclosed according to the invention "corresponds to" a polynucleotide having a sequence of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48,

25   50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, said gene encodes an RNA (processed or unprocessed, including naturally occurring splice variants and alleles) that is at least 90% identical, preferably at least 95% identical, most preferably at least 98% identical to, and especially identical to, an RNA that would be encoded by, or be complementary to, such as by hybridization with,

30   a polynucleotide having the indicated sequence. In addition, genes including sequences at least 90% identical to a sequence selected from SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40,

42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68, preferably at least about 95% identical to such a sequence, more preferably at least about 98% identical to such sequence and most preferably comprising such sequence are specifically contemplated by all of the processes of the present

5   invention. Sequences encoding the same proteins as any of these sequences, regardless of the percent identity of such sequences, are also specifically contemplated by any of the methods of the present invention that rely on any or all of said sequences, regardless of how they are otherwise described or limited. The polynucleotide sequences of the invention also include any open

10   reading frames, as defined herein, present within any of the sequences of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68.

15   The sequences disclosed herein may be genomic in nature and thus represent the sequence of an actual gene, such as a human gene, or may be a cDNA sequence derived from a messenger RNA (mRNA) and thus represent contiguous exonic sequences derived from a corresponding genomic sequence, or they may be wholly synthetic in origin for purposes of

20   practicing the processes of the invention. Because of the processing that may take place in transforming the initial RNA transcript into the final mRNA, the sequences disclosed herein may represent less than the full genomic sequence. They may also represent sequences derived from ribosomal and transfer RNAs. Consequently, the gene as present in the cell (and

25   representing the genomic sequence) and the polynucleotide transcripts disclosed herein, including cDNA sequences, may be identical or may be such that the cDNAs contain less than the full genomic sequence. Such genes and cDNA sequences are still considered "corresponding sequences" (as defined elsewhere herein) because they both encode the same or related

30   RNA sequences (i.e., related in the sense of being splice variants or RNAs at different stages of processing). Thus, by way of non-limiting example only, a gene that encodes an RNA transcript, which is then processed into a shorter

mRNA, is deemed to encode both such RNAs and therefore encodes an RNA complementary to (using the usual Watson-Crick complementarity rules), or that would otherwise be encoded by, a cDNA (for example, a sequence as disclosed herein). Thus, the sequences disclosed herein correspond to genes

5   contained in the cancerous cells (here, prostate cancer) and are used to determine gene activity or expression because they represent the same sequence or are complementary to RNAs encoded by the gene. Such a gene also includes different alleles and splice variants that may occur in the cells used in the methods of the invention, such as where recombinant cells are

10   used to assay for anti-neoplastic agents and such cells have been engineered to express a polynucleotide as disclosed herein, including cells that have been engineered to express such polynucleotides at a higher level than is found in non-engineered cancerous cells or where such recombinant cells express such polynucleotides only after having been engineered to do so.

15   Such engineering includes genetic engineering, such as where one or more of the polynucleotides disclosed herein has been inserted into the genome of such cell or is present in a vector.

Such cells, especially mammalian cells, may also be engineered to

20   express on their surfaces one or more of the polypeptides of the invention for testing with antibodies or other agents capable of masking such polypeptides and thereby removing the cancerous nature of the cell. Such engineering includes both genetic engineering, where the genetic complement of the cells is engineered to express the polypeptide, as well as non-genetic engineering,

25   whereby the cell has been physically manipulated to incorporate a polypeptide of the invention in its plasma membrane, such as by direct insertion using chemical and/or other agents to achieve this result.

In accordance with the foregoing, the present invention includes anti-

30   cancer agents that are themselves either polypeptides, or small chemical entities, that affect the cancerous process, including initiation, suppression or

NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. In a preferred embodiment, the animal to be so treated is a human patient.

5   The present invention is further drawn to a process for protecting an animal against cancer comprising administering to an animal at risk of developing cancer a therapeutically effective amount of a polynucleotide comprising the nucleotide sequence of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 10   50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68. Such polynucleotide may be either a DNA or an RNA.

         The present invention also presents a process for protecting an animal against cancer comprising administering to an animal at risk of developing 15   cancer a therapeutically effective amount of a polynucleotide comprising the nucleotide sequence of SEQ ID NO: 1, 3, 4, 6, 8, 10, 12, 14, 16, 17, 19, 20, 21, 23, 25, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 45, 47, 48, 50, 51, 52, 54, 56, 58, 60, 62, 64, 65, 67 and 68. Such polynucleotide may be either a DNA or an RNA.
20

         40. The process of claim 39 wherein said polynucleotide is a DNA.

         41. The process of claim 39 wherein said polynucleotide is an RNA.

25   The proteins encoded by the genes disclosed herein due to their expression, or elevated expression, in cancer cells, represent highly useful therapeutic targets for "targeted therapies" utilizing such affinity structures as, for example, antibodies coupled to some cytotoxic agent. In such methodology, it is advantageous that nothing need be known about the 30   endogenous ligands or binding partners for such cell surface molecules. Rather, an antibody or equivalent molecule that can specifically recognize the cell surface molecule (which could include an artificial peptide, a surrogate

ligand, and the like) that is coupled to some agent that can induce cell death or a block in cell cycling offers therapeutic promise against these proteins. Thus, such approaches include the use of so-called suicide "bullets" against intracellular proteins. For example, monoclonal antibodies may readily by

5   produced by methods well known in the art, for example, the method of Kohler and Milstein (see: *Nature*, **256**:495 (1975).

With the advent of methods of molecular biology and recombinant technology, it is now possible to produce antibody molecules by recombinant

10   means and thereby generate gene sequences that code for specific amino acid sequences found in the polypeptide structure of the antibodies. Such antibodies can be produced by either cloning the gene sequences encoding the polypeptide chains of said antibodies or by direct synthesis of said polypeptide chains, with *in vitro* assembly of the synthesized chains to form

15   active tetrameric (H_2L_2) structures with affinity for specific epitopes and antigenic determinants. This has permitted the ready production of antibodies having sequences characteristic of neutralizing antibodies from different species and sources.

        Regardless of the source of the antibodies, or how they are

20   recombinantly constructed, or how they are synthesized, *in vitro* or *in vivo*, using transgenic animals, such as cows, goats and sheep, using large cell cultures of laboratory or commercial size, in bioreactors or by direct chemical synthesis employing no living organisms at any stage of the process, all antibodies have a similar overall 3 dimensional structure. This structure is

25   often given as H_2L_2 and refers to the fact that antibodies commonly comprise 2 light (L) amino acid chains and 2 heavy (H) amino acid chains. Both chains have regions capable of interacting with a structurally complementary antigenic target. The regions interacting with the target are referred to as "variable" or "V" regions and are characterized by differences in amino acid

30   sequence from antibodies of different antigenic specificity.

The variable regions of either H or L chains contains the amino acid sequences capable of specifically binding to antigenic targets. Within these sequences are smaller sequences dubbed "hypervariable" because of their extreme variability between antibodies of differing specificity. Such

5   hypervariable regions are also referred to as "complementarity determining regions" or "CDR" regions. These CDR regions account for the basic specificity of the antibody for a particular antigenic determinant structure.

The CDRs represent non-contiguous stretches of amino acids within

10   the variable regions but, regardless of species, the positional locations of these critical amino acid sequences within the variable heavy and light chain regions have been found to have similar locations within the amino acid sequences of the variable chains. The variable heavy and light chains of all antibodies each have 3 CDR regions, each non-contiguous with the others

15   (termed L1, L2, L3, H1, H2, H3) for the respective light (L) and heavy (H) chains. The accepted CDR regions have been described by Kabat et al., *J. Biol. Chem.* **252**:6609-6616 (1977).

In all mammalian species, antibody polypeptides contain constant (i.e.,

20   highly conserved) and variable regions, and, within the latter, there are the CDRs and the so-called "framework regions" made up of amino acid sequences within the variable region of the heavy or light chain but outside the CDRs.

25   The antibodies disclosed according to the invention may also be wholly synthetic, wherein the polypeptide chains of the antibodies are synthesized and, possibly, optimized for binding to the polypeptides disclosed herein as being receptors. Such antibodies may be chimeric or humanized antibodies and may be fully tetrameric in structure, or may be dimeric and comprise only

30   a single heavy and a single light chain. Such antibodies may also include fragments, such as Fab and $F(ab_2)'$ fragments, capable of reacting with and binding to any of the polypeptides disclosed herein as being receptors.

In one aspect, the present invention relates to immunoglobulins, or antibodies, as described herein, that react with, especially where they are specific for, the polypeptides having amino acid sequences as disclosed

5   herein, preferably those having an amino acid sequence of one of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. Such antibodies may commonly be in the form of a composition, especially a pharmaceutical composition. Such antibodies, by themselves, may have therapeutic value in that they are able to bind to,

10   and thereby tie up, surface sites on cancerous cells. Where such sites have some type of function to perform (i.e., where they are surface enzymes, or channel structures, or structures that otherwise facilitate, actively or passively, the transport of nutrients and other vital materials to the cell. Such nutrients serve to facilitate the growth and replication of the cell and molecules that

15   bind to such sites and thereby interfere with such activities can prove to have a therapeutic effect in that the result of such binding is to remove sources of nutrients from such cells, thereby interfering with growth and replication. In like manner, such binding may serve to remove vital enzyme activities from the cell's functional repertoire, thereby also interfering with viability and/or the

20   ability of the cell to multiply or metastasize. In addition, by binding to such surface sites, the antibodies may serve to prevent the cells from reacting to environmental agents, such as cytokines and the like, that may facilitate growth, replication and metastasis, thereby further reducing the cancerous status of such cell and ameliorating the cancerous condition in a patient, even

25   without proving fatal to the cell or cells so affected.

The methods of the present invention also include processes wherein the cancer cell is contacted *in vivo* as well as *ex vivo* with an agent that comprises a portion, or is part of an overall molecular structure, having affinity for an expression product of a gene corresponding to a polynucleotide

30   sequence as disclosed herein, preferably where the expression product is a cell surface structure, most preferably a polypeptide as disclosed herein, such as one that comprises an amino acid sequence of SEQ ID NO: 2, 5, 7, 9, 11,

13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. In one such embodiment, said portion having affinity for said expression product is an antibody, especially where said expression product is a polypeptide or oligopeptide or comprises an oligopeptide portion, or
5   comprises a polypeptide.

In another aspect, the present invention also relates to an antibody that reacts with a polypeptide as disclosed herein, preferably a polypeptide comprising an amino acid sequence selected from the group consisting of
10   SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. Such an antibody may be polyclonal, monoclonal, recombinant or synthetic in origin. In one such embodiment, said antibody is associated, either covalently or non-covalently, with a cytotoxic agent, for example, an apoptotic agent. It is thus
15   contemplated that the antibody acts a targeted vector for guiding an associated therapeutic agent to a cancerous cell, such as a cell expressing a polypeptide homologous to, if not identical to, a polypeptide as disclosed herein.

20   Where the cytotoxic agent is itself a polypeptide, said may be linked directly to an antibody specific for a surface target on a cancer cell, such as where the polypeptide represents an extension of the amino acid chain of the antibody. In alternative embodiments, such molecules may be covalently linked through a linker sequence of long or short duration, such as an amino
25   acid sequence of 5 to 10 residues in length. Where the cytotoxic agents is some small organic molecule, such as a small organic compound, or some type of apoptotic agent, this may be covalently bonded to the antibody molecule or may be attached by some other type of non-covalent linkage, including hydrophobic and electrostatic linkages. Methods for forming such
30   linkages, especially covalent linkages, are well known to those skilled in the art.

The antibodies disclosed herein may also serve as targeting vectors for much larger structures, such as liposomes. In one such embodiment, an antibody is part of, or otherwise linked to, or associated with, a membranous structure, preferably a liposome or possibly some type of cellular organelle,

5   which acts as a reservoir for a cytotoxic agent, such as ricin. The antibody then acts to target said liposome to a cancerous tissue in an animal, whereupon the liposome provides a source of cytotoxic agents for localized treatment of a solid tumor or other type of neoplasm.

10   The present invention further encompasses an immunogenic composition comprising a polypeptide disclosed herein, as well as compositions formed using antibodies specific for these polypeptides.

       Methods well known in the art for making formulations are found in, for

15   example, *Remington: The Science and Practice of Pharmacy*, (19th ed.) Ed. A.R. Gennaro, 1995, Mack Publishing Company, Easton, PA. Formulations for parenteral administration may, for example, contain excipients, sterile water, or saline, polyalkylene glycols such as polyethylene glycol, oils of vegetable origin, or hydrogenated napthalenes. Biocompatible, biodegradable

20   lactide polymer, lactide/glycolide copolymer, or polyoxyethylene-polyoxypropylene copolymers may be used to control the release of the compounds. Other potentially useful parenteral delivery systems for agonists of the invention include ethylenevinyl acetate copolymer particles, osmotic pumps, implantable infusion systems, and liposomes. Formulations for

25   inhalation may contain excipients, or example, lactose, or may be aqueous solutions containing, for example, polyoxyethylene-9-lauryl ether, glycocholate and deoxycholate, or may be oily solutions for administration in the form of nasal drops, or as a gel. It should be noted that, where the therapeutic agent to be administered is an immunoconjugate, these sometimes contain

30   chemical linkages that are somewhat labile in aqueous media and therefor must be stored prior to administration is a more stable environment, such as in the form of a lyophilized powder.

Such an agent can be a single molecular structure, comprising both affinity portion and anti-cancer activity portions, wherein said portions are derived from separate molecules, or molecular structures, possessing such

5   activity when separated and wherein such agent has been formed by combining said portions into one larger molecular structure, such as where said portions are combined into the form of an adduct. Said anti-cancer and affinity portions may be joined covalently, such as in the form of a single polypeptide, or polypeptide-like, structure or may be joined non-covalently,

10   such as by hydrophobic or electrostatic interactions, such structures having been formed by means well known in the chemical arts. Alternatively, the anti-cancer and affinity portions may be formed from separate domains of a single molecule that exhibits, as part of the same chemical structure, more than one activity wherein one of the activities is against cancer cells, or tumor formation

15   or growth, and the other activity is affinity for an expression product produced by expression of genes related to the cancerous process or condition.

In one embodiment of the present invention, a chemical agent, such as a protein or other polypeptide, is joined to an agent, such as an antibody,

20   having affinity for an expression product of a cancerous cell, such as a polypeptide or protein encoded by a gene related to the cancerous process, preferably a gene as disclosed herein according to the present invention, most preferably a polypeptide sequence disclosed herein. Thus, where the presence of said expression product is essential to tumor initiation and/or

25   growth, binding of said agent to said expression product will have the effect of negating said tumor promoting activity. In one such embodiment, said agent is an apoptosis-inducing agent that induces cell suicide, thereby killing the cancer cell and halting tumor growth.

Other genes within the cancer cell that are regulated in a manner

30   similar to that of the genes disclosed herein and thus change their expression in a coordinated way in response to chemical compounds represent genes that are located within a common metabolic, signaling, physiological, or

functional pathway so that by analyzing and identifying such commonly regulated groups of genes (groups that include the gene, or similar sequences, disclosed according to the invention, one can (a) assign known genes and novel genes to specific pathways and (b) identify specific functions

5   and functional roles for novel genes that are grouped into pathways with genes for which their functions are already characterized or described. For example, one might identify a group of 10 genes, at least one of which is the gene as disclosed herein, that change expression in a coordinated fashion and for which the function of one, such as the polypeptide encoded by the

10   sequence disclosed herein, is known then the other genes are thereby implicated in a similar function or pathway and may thus play a role in the cancer-initiating or cancer-facilitating process. In the same way, if a gene were found in normal cells but not in cancer cells, or happens to be expressed at a higher level in normal as opposed to cancer cells, then a similar

15   conclusion may be drawn as to its involvement in cancer, or other diseases. Therefore, the processes disclosed according to the present invention at once provide a novel means of assigning function to genes, i.e. a novel method of functional genomics, and a means for identifying chemical compounds that have potential therapeutic effects on specific cellular pathways. Such

20   chemical compounds may have therapeutic relevance to a variety of diseases outside of cancer as well, in cases where such diseases are known or are demonstrated to involve the specific cellular pathway that is affected.

The polypeptides disclosed herein, preferably those of SEQ ID NO: 2,

25   5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69, also find use as vaccines in that, where the polypeptide represents a surface protein present on a cancer cell, or possibly non-surface proteins as well, such polypeptide may be administered to an animal, especially a human being, for purposes of activating cytotoxic T

30   lymphocytes (CTLs) that will be specific for, and act to lyze, cancer cells in said animal. Where used as vaccines, such polypeptides are present in the form of a pharmaceutical composition. The present invention may also employ

polypeptides that have the same, or similar, immunogenic character as the polypeptides of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69 and thereby elicit the same, or similar, immunogenic response after administration to an animal,

5   such as an animal at risk of developing cancer, or afflicted therewith. Thus, the polypeptides disclosed according to the invention will commonly find use as immunogenic compositions.

In addition, immunization with the DNA or RNA encoding the

10   polypeptides disclosed herein, preferably polynucleotide comprising the polynucleotide sequence of the invention, is specifically contemplated.

Expression of a gene corresponding to a polynucleotide disclosed herein, when in normal tissues, may indicate a predisposition towards

15   development of prostate cancer. The encoded polypeptide might then present a potentially useful cell surface target for therapeutic molecules such as cytolytic antibodies, or antibodies attached to cytotoxic, or cytolytic, agents.

The present invention specifically contemplates use of antibodies

20   against the polypeptides encoded by the polynucleotides corresponding to the genes disclosed herein, whereby said antibodies are conjugates to one or more cytotoxic agents so that the antibodies serve to target the conjugated immunotoxins to a region of cancerous activity, such as a solid tumor. For many known cytotoxic agents, lack of selectivity has presented a drawback to

25   their use as therapeutic agents in the treatment of malignancies. For example, the class of two-chain toxins, consisting of a binding subunit (or B-chain) linked to a toxic subunit (A-chain) are extremely cytotoxic. Thus, such agents as ricin, a protein isolated from castor beans, kills cells at very low concentrations (even less than 10^{-11} M) by inactivating ribosomes in said cells

30   (see, for example, Lord et al., Ricin: structure, mode of action, and some current applications. *Faseb J*, 8: 201-208 (1994), and Blättler et al., Realizing the full potential of immunotoxins. *Cancer Cells*, 1: 50-55 (1989)). While

isolated A-chains of protein toxins that functionally resemble ricin A-chain are only weakly cytotoxic for intact cells (in the concentration range of 10^{-7} to 10^{-6} M), they are very potent cytotoxic agents inside the cells. Thus, a single molecule of the A-subunit of diphtheria toxin can kill a cell once inside (see:

5   Yamaizumi et al., One molecule of diphtheria toxin fragment A introduced into a cell can kill the cell. Cell, *15:* 245-250, 1978).

The present invention solves this selectivity problem by using antibodies specific for antigens present on cancer cells to target the cytotoxins to said cells. In addition, use of antibodies decreases toxicity because the

10   antibodies are non-toxic until they reach the tumor and, because the cytotoxin is bound to the antibody, it is presented with less opportunity to cause damage to non-targeted tissues.

In addition, use of such antibodies alone can provide therapeutic

15   effects on the tumor through the antibody-dependent cellular cytotoxic response (ADCC) and complement-mediated cell lysis mechanisms.

A number of recombinant immunotoxins (for example, consisting of Fv regions of cancer specific antibodies fused to truncated bacterial toxins) are

20   well known (see, for example, Smyth et al., Specific targeting of chlorambucil to tumors with the use of monoclonal antibodies, *J. Natl. Cancer Inst.*, 76(3):503-510 (1986); Cho et al., Single-chain Fv/folate conjugates mediate efficient lysis of folate-receptor-positive tumor cells, *Bioconjug. Chem.*, 8(3):338-346 (1997)). As noted in the literature, these may contain, for

25   example, a truncated version of *Pseudomonas* exotoxin as a toxic moiety but the toxin is modified in such a manner that by itself it does not bind to normal human cells, but it retains all other functions of cytotoxicity. Here, recombinant antibody fragments target the modified toxin to cancer cells which are killed, such as by direct inhibition of protein synthesis, or by concomitant induction of

30   apoptosis. Cells that are not recognized by the antibody fragment, because they do not carry the cancer antigen, are not affected. Good activity and specificity has been observed for many recombinant immunotoxins in *in vitro*

assays using cultured cancer cells as well as in animal tumor models. Ongoing clinical trials provide examples where the promising pre-clinical data correlate with successful results in experimental cancer therapy. (see, for example, Brinkmann U., Recombinant antibody fragments and immunotoxin

5   fusions for cancer therapy, *In Vivo* (2000) **14**:21-27).

While the safety of employing immunoconjugates in humans has been established, *in vivo* therapeutic results have been less impressive. Because clinical use of mouse MAbs in humans is limited by the development of a

10   foreign anti-globulin immune response by the human host, genetically engineered chimeric human-mouse MAbs have been developed by replacing the mouse Fc region with the human constant region. In other cases, the mouse antibodies have been "humanized" by replacing the framework regions of variable domains of rodent antibodies by their human equivalents. Such

15   humanized and engineered antibodies can even be structurally arranged to have specificities and effector functions determined by design and which characteristics do not appear in nature. The development of bi-specific antibodies, having different binding ends so that more than one antigenic site can be bound, have proven useful in targeting cancer cells. Thus, such

20   antibody specificity has been improved by chemical coupling to various agents such as bacterial or plant toxins, radionuclides or cytotoxic drugs and other agents. (see, for example, Bodey, B. et al). Genetically engineered monoclonal antibodies for direct anti-neoplastic treatment and cancer cell specific delivery of chemotherapeutic agents. *Curr Pharm Des* (2000)

25   Feb;6(3):261-76). See also, Garnett, M. C., Targeted drug conjugates: principles and progress. *Adv. Drug Deliv. Rev.* (2001 Dec 17) **53**(2):171-216; Brinkmann et al., Recombinant immunotoxins for cancer therapy. *Expert Opin Biol Ther.* (2001) **1**(4):693-702.

30   Among the cytotoxic agents specifically contemplated for use as immunoconjugates according to the present invention are Calicheamicin, a highly toxic enediyne antibiotic isolated from *Micromonospora*

echinospora ssp. Calichensis, and which binds to the minor groove of DNA to induce double strand breaks and cell death (see: Lee et al., Calicheamicins, a novel family of antitumor antibiotics. 1. Chemistry and partial structure of calichemicin g_1. *J Am Chem Soc*, **109**: 3464-3466 (1987);

5   Zein et al., Calicheamicin gamma 1I: an antitumor antibiotic that cleaves double-stranded DNA site specifically, *Science*, **240**: 1198-1201 (1988)). Useful derivatives of the calicheamicins include mylotarg and 138H11-Camθ. Mylotarg is an immunoconjugate of a humanized anti-CD33 antibody (CD33 being found in leukemic cells of most patients with acute myeloid leukemia)

10 and N-acetyl gamma colicheamicin dimethyl hydrazide, the latter of which is readily coupled to an antibody of the present invention (in place of the anti-CD33 but which can also be humanized by substitution of human framework regions into the antibody during production as described elsewhere herein) to form an immunoconjugate of the invention. (see: Hamann et al. Gemtuzumab

15 Ozogamicin, A Potent and Selective Anti-CD33 Antibody-Calicheamicin Conjugate for Treatment of Acute Myeloid Leukemia, *Bioconjug. Chem.* **13**, 47-58 (2002)) For use with 138H11-Camθ, 138H11 is an anti-γ-glutamyl transferase antibody coupled to theta calicheamicin through a disulfide linkage and found useful *in vitro* against cultured renal cell carcinoma cells.

20 (see: Knoll et al., Targeted therapy of experimental renal cell carcinoma with a novel conjugate of monoclonal antibody 138H11 and calicheamicin θ_1^I, *Cancer Res*, **60**: 6089-6094 (2000) The same linkage may be utilized to link this cytotoxic agent to an antibody of the present invention, thereby forming a targeting structure for prostate cancer cells.

25

Also useful in forming the immunoconjugates of the invention is DC1, a disulfide-containing analog of adozelesin, that kills cells by binding to the minor groove of DNA, followed by alkylation of adenine bases. Adozelesin is a structural analog of CC-1065, an anti-tumor antibiotic isolated from microbial

30 fermentation of *Streptomyces zelensis*, and is about 1,000 fold more toxic to cultured cell lines that other DNA interacting agents, such as cis-platin and doxorubicin. This agent is readily linked to antibodies through the disulfide

bond of adozelesin. (see: Chari et al., Enhancement of the selectivity and antitumor efficacy of a CC-1065 analogue through immunoconjugate formation, *Cancer Res*, **55**: 4079-4084 (1995)).

5   Maytansine, a highly cytotoxic microtubular inhibitor isolated from the shrub *Maytenus serrata* found to have little value in human clinical trials, is much more effective in its derivatized form, denoted DM1, containing a disulfide bond to facilitate linkage to antibodies, is up to 10-fold more cytotoxic (see: Chari et al., Immunoconjugates containing novel maytansinoids: 10   promising anticancer drugs, *Cancer Res*, **52**: 127-131 (1992)). These same *in vitro* studies showed that up to four DM1 molecules could be linked to a single immunoglobulin without destroying the binding affinity. Such conjugates have been used against breast cancer antigens, such as the *neu*/HER2/*erbB-2* antigen. (see: Goldmacher et al., Immunogen, Inc., (2002) *in press*); also see 15   Liu, C. et al., Eradication of large colon tumor xenografts by targeted delivery of maytansinoids, *Proc. Natl. Acad. Sci. USA*, **93**, 8618-8623 (1996)). For example, Liu et al. (1996) describes formation of an immunoconjugate of the maytansinoid cytotoxin DM1 and C242 antibody, a murine IgG1 immunoglobulin, available from Pharmacia and which has affinity for a mucin-20   like glycoprotein variably expressed by human colorectal cancers. The latter immunoconjugate was prepared according to Chari et al., *Cancer Res.*, 52:127-131 (1992) and was found to be highly cytotoxic against cultured colon cancer cells as well as showing anti-tumor effects *in vivo* in mice bearing subcutaneous COLO 205 human colon tumor xenografts using doses well 25   below the maximum tolerated dose.

          In addition, there are a variety of protein toxins (cytotoxic proteins), which include a number of different classes, such as those that inhibit protein synthesis: ribosome-inactivating proteins of plant origin, such as ricin, abrin, 30   gelonin, and a number of others, and bacterial toxins such as pseudomonas exotoxin and diphtheria toxin.

Another useful class is the one including taxol, taxotere, and taxoids. Specific examples include paclitaxel (taxol), its analog docetaxel (taxotere), and derivatives thereof. The first two are clinical drugs used in treating a number of tumors while the taxoids act to induce cell death by inhibiting the

5   de-polymerization of tubulin. Such agents are readily linked to antibodies through disulfide bonds without disadvantageous effects on binding specificity.

In one instance, a truncated Pseudomonas exotoxin was fused to an

10 anti-CD22 variable fragment and used successfully to treat patients with chemotherapy-resistant hairy-cell leukemia. (see: Kreitman et al., Efficacy of the anti-CD22 recombinant immunotoxin BL22 in chemotherapy-resistant hairy-cell leukemia, N Engl J Med, 345: 241-247 (2001)) Conversely, the cancer-linked peptides of the present invention offer the opportunity to

15 prepare antibodies, recombinant or otherwise, against the appropriate antigens to target solid tumors, preferably those of malignancies of prostate tissue, using the same or similar cytotoxic conjugates. Thus, many of the previously used immunoconjugates have been formed using antibodies against general antigenic sites linked to cancers whereas the antibodies

20 formed using the peptides disclosed herein are more specific and target the antibody-cytotoxic agent to a particular tissue or organ, thus further reducing toxicity and other undesirable side effects.

In addition, the immunoconjugates formed using the antibodies

25 prepared against the cancer-linked antigens disclosed herein can be formed by any type of chemical coupling. Thus, the cytotoxic agent of choice, along with the immunoglobulin, can be coupled by any type of chemical linkage, covalent or non-covalent, including electrostatic linkage, to form the immunoconjugates of the present invention.

30

When used as immunoconjugates, the antitumor agents of the present invention represent a class of pro-drugs that are relatively non-toxic when first

administered to an animal (due mostly to the stability of the immunoconjugate), such as a human patient, but which are targeted by the conjugated immunoglobulin to a cancer cell where they then exhibit good toxicity. The tumor-related, associated, or linked, antigens, preferably those

5   presented herein, serve as targets for the antibodies (monoclonal, recombinant, and the like) specific for said antigens. The end result is the release of active cytotoxic agent inside the cell after binding of the immunoglobulin portion of the immunoconjugate.

10   The cited references describe a number of useful procedures for the chemical linkage of cytotoxic agents to immunoglobulins and the disclosures of all such references cited herein are hereby incorporated by reference in their entirety. For other reviews see Ghetie et al., Immunotoxins in the therapy of cancer: from bench to clinic, *Pharmacol Ther*, **63**: 209-234 (1994), Pietersz

15   et al. The use of monoclonal antibody immunoconjugates in cancer therapy, *Adv Exp Med Biol*, **353**:169-179 (1994), and Pietersz, G. A. The linkage of cytotoxic drugs to monoclonal antibodies for the treatment of cancer, *Bioconjug Chem*, **1**:89-95 (1990).

20   Thus, the present invention provides highly useful cancer-associated antigens for generation of antibodies for linkage to a number of different cytotoxic agents which are already known to have some *in vitro* toxicity and possess chemical groups available for linkage to antibodies.

25   Because the polypeptides disclosed herein are diagnostic for prostate cancer, the present invention offers a method for diagnosing prostate cancer in a patient comprising determining the presence of a cancer-related polypeptide in one or more prostate cells of said patient wherein said cancer-related polypeptide comprises a polypeptide that reacts with an antibody

30   specific for a polypeptide having an amino acid sequence selected from SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. In a preferred embodiment thereof, the

cancer-related polypeptide comprises a polypeptide of SEQ ID NO: 2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69. In a highly preferred embodiment, the cancer-related polypeptide is a member selected from the group consisting of SEQ ID NO:

5   2, 5, 7, 9, 11, 13, 15, 18, 22, 24, 27, 29, 31, 33, 35, 37, 39, 41, 43, 46, 53, 55, 57, 59, 61, 63, 66 and 69.

The present invention also relates to a process that comprises a method for producing a product, including the generation of test data,

10   comprising identifying an agent according to one of the disclosed processes for identifying such an agent (i.e., the therapeutic agents identified according to the assay procedures disclosed herein) wherein said product is the data collected with respect to said agent as a result of said identification process, or assay, and wherein said data is sufficient to convey the chemical character

15   and/or structure and/or properties of said agent. For example, the present invention specifically contemplates a situation whereby a user of an assay of the invention may use the assay to screen for compounds having the desired enzyme modulating activity and, having identified the compound, then conveys that information (i.e., information as to structure, dosage, etc) to

20   another user who then utilizes the information to reproduce the agent and administer it for therapeutic or research purposes according to the invention. For example, the user of the assay (user 1) may screen a number of test compounds without knowing the structure or identity of the compounds (such as where a number of code numbers are used the first user is simply given

25   samples labeled with said code numbers) and, after performing the screening process, using one or more assay processes of the present invention, then imparts to a second user (user 2), verbally or in writing or some equivalent fashion, sufficient information to identify the compounds having a particular modulating activity (for example, the code number with the corresponding

30   results). This transmission of information from user 1 to user 2 is specifically contemplated by the present invention.

It should be cautioned that, in carrying out the procedures of the present invention as disclosed herein, whether to form immunoconjugates or screen for other antitumor agents using the genes and polypeptides disclosed herein, any reference to particular buffers, media, reagents, cells, culture

5   conditions and the like are not intended to be limiting, but are to be read so as to include all related materials that one of ordinary skill in the art would recognize as being of interest or value in the particular context in which that discussion is presented. For example, it is often possible to substitute one buffer system or culture medium for another and still achieve similar, if not

10   identical, results. Those of skill in the art will have sufficient knowledge of such systems and methodologies so as to be able, without undue experimentation, to make such substitutions as will optimally serve their purposes in using the methods and procedures disclosed herein.

15   The present invention will now be further described by way of the following non-limiting example. In applying the disclosure of the example, it should be kept clearly in mind that other and different embodiments of the methods disclosed according to the present invention will no doubt suggest themselves to those of skill in the relevant art. The following example shows

20   how a potential anti-neoplastic agent may be identified using one or more of the genes disclosed herein.

EXAMPLE

25 ·

Determination of Gene Inhibitory Activity of an Anti-neoplastic Agent

SW480 cells are grown to a density of 10^5 cells/cm^2 in Leibovitz's L-15 medium supplemented with 2 mM L-glutamine (90%) and 10% fetal bovine

30   serum. The cells are collected after treatment with 0.25% trypsin, 0.02% EDTA at 37°C for 2 to 5 minutes. The trypsinized cells are then diluted with 30 ml growth medium and plated at a density of 50,000 cells per well in a 96 well

plate (100 µl/well). The following day, cells are treated with either compound buffer alone, or compound buffer containing a chemical agent to be tested, for 24 hours. The media is then removed, the cells lysed and the RNA recovered using the RNAeasy reagents and protocol obtained from Qiagen. RNA is

5   quantitated and 10 ng of sample in 1 µl are added to 24 µl of Taqman reaction mix containing 1X PCR buffer, RNAsin, reverse transcriptase, nucleoside triphosphates, amplitaq gold, tween 20, glycerol, bovine serum albumin (BSA) and specific PCR primers and probes for a reference gene (18S RNA) and a test gene (Gene X). Reverse transcription is then carried out at 48°C for 30

10   minutes. The sample is then applied to a Perlin Elmer 7700 sequence detector and heat denatured for 10 minutes at 95°C. Amplification is performed through 40 cycles using 15 seconds annealing at 60°C followed by a 60 second extension at 72°C and 30 second denaturation at 95°C. Data files are then captured and the data analyzed with the appropriate baseline

15   windows and thresholds.

The quantitative difference between the target and reference gene is then calculated and a relative expression value determined for all of the samples used. In this way, the ability of a chemotherapeutic agent to

20   effectively and selectively reduce the activity of a cancer-specific gene is readily ascertained. The overall expression of the cancer-specific gene, as modulated by one chemical agent relative to another, is also determined. Chemical agents having the most effect in reducing gene activity are thereby .identified as the most anti-neoplastic.

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